

Pain Neuroscience Education Clinical Pearl

Emily Ahern, SPT, Sarah Case, PT, DScPT

According to the CDC, chronic pain frequently limits life and work activities and is among the most common reasons adults seek medical care.¹ Chronic pain is directly associated with decreased quality of life, opioid addiction, and a decline in mental health.¹ In 2019, the CDC reported 20.4% of adults suffered from chronic pain and 7.4% reported pain limited life or work activities within the past three months (referred to as high-impact chronic pain).¹ Overall, women were more likely to experience chronic pain (21.7%) as compared to men (19.0%).¹ Indeed, chronic pain is a significant health issue experienced by many patients treated by healthcare practitioners. The primary purpose of this review is to provide clinicians with an overview of Pain Neuroscience Education (PNE) and strategies on how to implement PNE into clinical practice.

What is PNE?

PNE stands for Pain Neuroscience Education and is an educational process for teaching patients about pain. It has been shown that when patients understand the biology and neurophysiology behind their pain experiences, they have less pain, less disability, better mobility, improved cognition, and decreased sensitization of the nervous system.² The goal of PNE is to address chronic pain through education, not eliminate the pain.

Cartesian Model of Pain

The Cartesian model of pain is the traditional way to describe what happens during a painful experience and is commonly associated with the picture seen in Figure 1. The picture depicts a person who is having a painful experience. The individual places their foot in the fire, which sends a signal up a wire to the brain where a “bell” sounds, leading to an experience of pain. Therefore, three pain treatment strategies emerge: 1) remove the foot from the fire, 2) extinguish the fire, or 3) cut the wire.²



Figure 1: Cartesian Model of Pain

However, this model has led to many misconceptions about pain, particularly chronic pain. First, pain is not always associated with tissue damage nor is pain always associated with injury. It is possible to experience pain with healthy tissues and conversely, to have damaged tissues and experience no pain. According to the Cartesian model, chronic pain is associated with damaged tissue that is not healing. This is not always true – we know patients experience chronic pain with healthy tissues. Secondly, another common misconception with this model is that all pain is caused by injury and increased pain indicates more damage to tissues.

Pain Neuroscience Education Clinical Pearl

Emily Ahern, SPT, Sarah Case, PT, DScPT

Furthermore, this picture illustrates pain as an “input driven system” where pain is coming into the brain from an outside source.² Therefore, the Cartesian model is outdated and PNE is a more useful technique for understanding pain.

Common Terminology with PNE

There are a variety of key terms associated with PNE. This section will provide a brief overview of a few important terms. A summary of terms and definitions can be found in Table 1. For further exploration, please visit [the International Association for the Study of Pain \(IASP\) website](#).³

Table 1: Definitions of common terms associated with PNE

Term	Definition
Pain	“An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.” ³
Nociception	“Neural process of encoding a noxious stimuli.” ³
Nociceptors	Receptors in tissues that send “danger” signals to the brain to identify tissue injuries. ³
Nociceptive pain	Pain originating from damage to the body’s tissues. ³
Nociplastic pain	Pain arising from altered nociception, resulting from a lack of tissue damage. ³
Sensitization	A process where nociceptive neurons become abnormally hypersensitive to normal stimuli, leading to a drop in pain threshold. ³
Central Sensitization	When a patient’s pain is based in the CNS. ³ <ul style="list-style-type: none">● Includes cerebral hemispheres, brain stem, spinal cord● This type of pain is diffuse
Peripheral sensitization	“Increased responsiveness and reduced threshold of nociceptive neurons in the periphery to the stimulation of their receptive fields.” ³

According to IASP, pain is defined as, “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.”³ There are six key features associated with pain:

1. “Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors.”³

Pain Neuroscience Education Clinical Pearl

Emily Ahern, SPT, Sarah Case, PT, DScPT

2. “Pain and nociception are different phenomena. Pain cannot be inferred solely from activity in sensory neurons.”³
3. “Through their life experiences, individuals learn the concept of pain.”³
4. “A person’s report of an experience as pain should be respected.”³
5. “Although pain usually serves an adaptive role, it may have adverse effects on function and social and psychological well-being.”³
6. “Verbal description is only one of several behaviors to express pain; inability to communicate does not negate the possibility that a human or nonhuman animal experiences pain.”³

A nociceptive stimulus refers to an event that causes, or potentially causes, a tissue-damaging event, in which the information is encoded by nociceptors.³ A nociceptor describes a type of sensory receptor, located in the PNS, that encodes and transmits noxious stimuli. Similarly, a nociceptive neuron carries noxious information through either the central nervous system (CNS) or peripheral nervous system (PNS). Nociceptive pain originates from damage to the body’s tissues from the activation of nociceptors and is specifically caused by a normally functioning somatosensory system. Conversely, nociplastic pain refers to pain arising from altered nociception, characterized by a lack of evidence indicating actual tissue damage.³

Sensitization, central sensitization, and peripheral sensitization directly relate to one another. Sensitization refers to a process where nociceptive neurons become abnormally hypersensitive to normal stimuli, leading to a drop in pain threshold.³ Central sensitization is the same process specifically referring to neurons located within the CNS, which may be caused by a malfunction of the brain’s endogenous pain control system.³ Peripheral sensitization similarly refers to a reduced threshold of nociceptor neurons in the PNS.³ This type of pain is described as disproportionate, diffuse pain with palpation tenderness, and pain that is present beyond the normal healing time. Patients often describe this pain as, “everything hurts” which can be associated with psychological issues as well.² Common terminology is effective for practitioners to communicate with other healthcare providers.

Important PNE concepts

The content of PNE helps patients understand the neurophysiology behind their pain experience. It is important to avoid referencing only anatomical models or tissue-based explanations about pain. When patients need help with pain, it is important to teach them about the biopsychosocial, cultural, and contextual aspects as well. While the content appears biological and physiological, PNE is delivered using metaphors and stories to place the pain

Pain Neuroscience Education Clinical Pearl

Emily Ahern, SPT, Sarah Case, PT, DScPT

experience in the context of the patient's life. The main takeaway is to teach the patient that they have more options than pharmacological methods for managing pain. Rehabilitation specialists are very well suited for treating pain because they have expertise in various non-pharmacological interventions, which address the whole person.

Implementation Strategies

Typically, patients suffering from chronic pain can be difficult to treat. They may be afraid to move, palpation hurts, and they don't understand what is happening. Hence, there are effective strategies on how to best treat these patients clinically.

One strategy is to set aside specific times used solely for PNE. The best time to schedule patients for PNE is immediately before lunch. Some outpatient clinics have more time in the middle of the day, which allows flexibility for difficult chronic pain cases. When patients call to schedule an initial evaluation for a chronic pain condition, the front office staff could "screen" patients to correctly judge how much time is needed to assess and educate patients.²

PNE can be provided individually or as a group session. If PNE happens in a group setting, it is encouraged to put "like-minded" individuals together in the same group and to keep the group to approximately 10-12 individuals. Groups can meet about once per week, and it is important to provide patients materials for their own self-study.²

PNE works best when used in conjunction with other treatments.² Other treatment methods that have been used include manual therapy, therapeutic exercise, therapeutic activity, and modalities.

Outcomes/Evidence

According to a systematic review from Siddall, et al (2022) of five high-quality randomized controlled trials (RCTs), the utilization of PNE combined with exercise demonstrated a significant decline in pain, disability, kinesiophobia, and pain catastrophization.⁴ Additionally, a systematic review and meta-analysis of RCTs, performed by Marris, et al (2019), also found that patients reported a decrease in pain and disability when PNE was used in conjunction with physical therapy treatments.⁵ Furthermore, Louw, et al (2016) systematic review reported the use of PNE supplemented with other active movement-based physical therapy interventions was best for significant reduction in pain ratings among patients.⁶

Coding and Billing for PNE

Many clinicians are unsure of how to properly code/bill for PNE when used clinically. PNE is reimbursed well as neuromuscular re-education.² It can also be billed as Therapeutic Exercise, Therapeutic Activity, or Cognitive Functional Training.

Pain Neuroscience Education Clinical Pearl

Emily Ahern, SPT, Sarah Case, PT, DScPT

Summary

In conclusion, PNE is an educational process that teaches patients about pain, utilizing metaphors and stories to explain the underlying neurophysiology. PNE is best used with other treatments such as manual therapy, therapeutic exercise, therapeutic activity, and modalities. Patients suffering from chronic pain are genuinely burdened by a decreased quality of life. As practitioners, it is important to respect the patient's experience with pain and explore creative ways to improve the patient's outlook on life.

Pain Neuroscience Education Clinical Pearl

Emily Ahern, SPT, Sarah Case, PT, DScPT

References

1. Zelaya CE, Dahlhamer JM, Lucas JW, Connor EM. Chronic pain and high-impact chronic pain among U.S. adults, 2019. Centers for Disease Control. November 2020. Accessed March 24, 2022.
<https://www.cdc.gov/nchs/products/databriefs/db390.htm#:~:text=Key%20findings,-Data%20from%20the&text=In%202019%2C%2020.4%25%20of%20adults,adults%20aged%2065%20and%20over.>
2. Louw A, Puentedura E, Schmidt S, Zimney K, Podolak J, Rico D, Cox T, Freund B, Goldrick S, Neilson B, Kruse A, Vogsland R, Marth L. Therapeutic Neuroscience Education 1: Teaching People About Pain. Evidence in Motion. March 8-29, 2021. Online course.
3. Terminology. International Association for the Study of Pain. Accessed March 25, 2022.
<https://www.iasp-pain.org/resources/terminology/>
4. Siddall B, Ram A, Jones MD, Booth J, Perriman D, Summers SJ. Short-term impact of combining pain neuroscience education with exercise for chronic musculoskeletal pain: a systematic review and meta-analysis. *Pain*. 2022;163(1):e20-e30.
5. Marris D, Theophanous K, Cabezon P, Dunlap Z, Donaldson M. The impact of combining pain education strategies with physical therapy interventions for patients with chronic pain: a systematic review and meta-analysis of randomized controlled trials. *Physiother Theory Pract*. 2019;37(4):461-472.
6. Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: a systematic review of the literature. *Physiother Theory Pract*. 2016;32(5):332-355.